EPA Region 8 Laboratory
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TECHNICAL STANDARD OPERATING PROCEDURE

SOP No.: FLDM-720 Rev.: 1.0

TITLE: Field Sampling Procedure

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Effective Date: 11/10/10

Revision/Change History

Revision	Change Description	Effective Date
1.0	Changed SOP# from 720 to FLDM-720 Rev. 1.0. Updated to new formatting. Updated methods.	11/10/10

1. Purpose

The purpose of this document is to outline and describe basic EPA water quality sampling techniques and processes.

2. Scope & Application

The methods and procedures described in this document should be used for the collection and analysis of samples for the Region 8 laboratory, except for events that require different procedures for collection and analysis of samples or when other special circumstances exist.

3. Summary of Method

This document serves as a basic water quality sampling Standard Operating Procedure (SOP) and does not describe all possible types of water quality sampling. It is important to note that procedures used in the field can vary depending on the types of water quality parameters to be analyzed, the characteristics of the sampling location, and the data quality objectives for the sampling event.

4. Personnel Qualifications and Responsibilities

4.1. All sampling must be performed by trained personnel.

5. Definitions

5.1. **COC** – Chain of Custody form
5.2. **DI** – Deionized water
5.3. **DM** - Dissolved metals
5.4. **LDO** – Luminescent Dissolved Oxygen
5.5. **PSI** – Pounds per Square Inch
5.6. **TM** - Total metals

6. Interferences (Not Applicable)

7. Health, Safety, and Cautions

7.1. Disposable gloves must be worn at all times during the preservation process.
7.2. Eye protection is required during acidification of samples and otherwise recommended.
7.3. Do not discard the water in the cubitainer until all acid preservation and steps are complete.

8. Equipment and Supplies

8.1. Cubitainers
8.2. Sample collector such as a Van Dorn sampler, 2 meter integrated sampler, or bucket
8.3. Indelible Ink Pens
8.4. Sample bottle identification labels
8.5. 0.45 micron filters(syringe type or vacuum filter)
8.6. Vacuum Pump capable of 15 PSI
8.7. 0.5 mL ampules (if applicable)
8.8. Disposable nitrile gloves
8.9. Ice
8.10. Multi-parameter Meters (Hydrolab or In-Situ Multiprobe)
    8.10.1. pH sensor
    8.10.2. LDO sensor
    8.10.3. Conductivity sensor
    8.10.4. Temperature sensor

8.11. Velocity Meter Probe (Marsh-McBirney) or Price AA or Pygmy
8.12. Wading Rod
8.13. Tape Measurer (50 foot or longer)
8.14. Stopwatch
8.15. Ice Chest (Cooler)
8.16. Large Ziploc or mesh bags (gallon size)
8.17. Packing or Duct Tape
8.18. Batteries

9. Reagents and Standards

9.1. E-Pure/Nanopure Water (for blanks)
9.2. Deionized Water (for rinse water)
9.3. Nitric Acid (HNO_3)
9.4. $CaCO_3$/water mixture
9.5. Sulfuric Acid (H_2SO_4)
9.6. Hydrochloric Acid (HCl)
9.7. pH Buffers 4 and 7 in acidic conditions, Buffers 7 and 10 in alkaline conditions
9.8. Specific Conductivity calibration solution (950 µS/cm or higher)

10. Quality Control and Quality Assurance

10.1. Collect a minimum of one set of quality control samples (blank and duplicate) for every 20 locations sampled. This will vary depending on project specific quality assurance project plans and/or sampling and analysis plans.
  10.1.1. Blanks determine whether or not procedures followed in the field affect sample quality.
  10.1.2. Duplicates and replicates determine if data are reproducible.
  10.1.3. If quality control samples reveal a problem, data will be qualified and sampling and analysis procedures will be evaluated to determine the source of the problem.
10.2. Collect duplicate samples using the same procedures as regular samples. Duplicate samples will be collected at the same or as close to the same time as possible.
10.3. A sample blank will be collected for each sample collected during normal sampling, using e-pure/nanopure water and the same procedures used in normal sample collection. Blanks may not be applicable to all samples such as benthic macroinvertebrate or phytoplankton speciation samples.

11. Procedure/Method

11.1. Sample Handling

11.1.1. **Sampling Location:**
  11.1.1.1. If possible, choose sampling locations that allow easy access and are safe to enter, but do not bias the sample.
  11.1.1.2. In events where samples are to be collected downstream of a tributary or infow, choose an area where water is well mixed.
    11.1.1.2.1. Look for differing characteristics along both banks.
    11.1.1.2.2. Differences in color or the presence of foam along one bank and not the other could mean that the sampling location is not well mixed.
    11.1.1.2.3. Proceed further downstream to sample.
  11.1.1.3. Sample downstream locations first and proceed upstream when possible.
  11.1.1.4. When sampling on private property, always get permission.

11.1.2. **Sample Collection:**

11.1.2.1. Water quality samples should be collected before any other work is performed in the stream.

11.1.2.2. Personnel should be sure not to disturb upstream substrate while samples are being collected. In the event that substrate has been disturbed, proceed upstream of the disturbance to collect water quality samples.

11.1.2.3. Label containers with the sampling station ID and the analysis to be performed on the sample.

11.1.2.4. Sample analysis type should be clearly written on the sample ID.

11.1.2.5. Use the following abbreviations for common laboratory analyses:

Sample Type	Abbreviation
Total Recoverable Metals	TM
Dissolved Metals	DM
Alkalinity/Anions	Alk/anions
Nutrients	Nuts
Total Nitrogen	TN
Total Phosphorus	TP
Chlorophyll a	Chlor
Pesticides Primary Personal Care Products	Pest/PPCPs
Waste Indicators	WI
Volatile Organic Compounds	VOCs

11.1.2.6. Samples can either be collected directly into a cubitainer from the stream or by using a triple rinsed sample collector such as a Van Dorn sampler, 2 meter integrated sampler, or bucket.

11.1.2.7. Expand cubitainers to their full size by manually pulling them apart.

11.1.2.7.1. This is easiest completed by unscrewing the cap, pulling out the neck, and pulling the sides of the cubitainer from the outside.

11.1.2.7.2. Expanding cubitainers with dry hands is more effective.

11.1.2.8. Choose the area of stream to be sampled. This location should be in an area where the stream is the deepest, flowing, and where water is well mixed. This is usually the thalweg of the stream.

11.1.2.9. Fill all cubitainers approximately ¼ full with native water, cap, shake vigorously, then discard downstream; repeat two more times.

11.1.2.9.1. Be sure that all water is poured out between each rinse by gripping cubitainers under the plastic ring.

11.1.2.9.2. Cubitainers should not be touched on the inside once they have been rinsed.

11.1.2.9.3. Disposable gloves must be worn at all times during the sample collection and rinsing procedure.

11.1.2.9.4. If an alternate sample collection device is used to collect water, be sure to also rinse it three times with native water prior to collecting the sample.

11.1.2.10. After rinsing, completely fill cubitainers with native water to within ½“ of the throat and lightly secure caps.

11.1.3. **Sample Labels and Chains of Custody (COCs) (GENLF-001):**

11.1.3.1. Always use pens with indelible ink that will not smear with water.

11.1.3.2. Permanent markers may be used on sample labels (not on COCs) when problems are encountered with pens.

11.1.3.3. Write legibly.

11.1.3.4. Do not fill out tags and field forms on top of COCs because of the "carbon copy effect", which marks up carbon copies underneath the top paper.

11.1.3.5. When a mistake is made on tags or COCs, cross out the error with a single line, initial it and write in the correction. The same procedure should also be followed when errors are made in the field notebook.

11.1.3.6. Write the project name and Laboratory Services Request (LSR) number in the box provided.

11.1.3.7. Be sure that at least one sampler prints and signs his or her name in the sampler box. At a minimum, the field lead or custodian normal signs the form.

11.1.3.8. The remaining lines on the COC are used to describe the analyses to be performed on each sample.

11.1.3.9. Any sample that is not listed on the COC will not be analyzed by the laboratory; therefore, it is very important to log all samples.

11.1.3.10. Provide each sample with a station number, a description of where it was collected (SAMPLE ID), date, time, matrix, preservative, analysis, number of containers, and Bottle ID in the spaces provided.

11.1.3.11. Codes to use for preservatives and matrix are on the bottom of the chain of custody and remarks can be made in the last column.

11.1.3.12. Keep the same analyte order for each COC form. This will help prevent error and reduce confusion. The recommended order for common samples are as follows:

11.1.3.12.1. Total Recoverable Metals,

11.1.3.12.2. Dissolved Metals,

11.1.3.12.3. Alkalinity/Anions,

11.1.3.12.4. Nutrients, and

11.1.3.12.5. Chlorophyll a.

11.1.3.13. Be sure to pair the appropriate Bottle ID with its corresponding sample.

11.1.3.14. Using Bottle IDs in sequential order can also help prevent error.

11.1.3.15. When sending samples to the laboratory, be sure to date and sign the "Relinquished By" box at the bottom of the COC.

11.1.3.16. Write "In Transit Via FedEx" (or UPS if applicable) in the corresponding "Received By" box.

11.1.3.17. Make sure that all samples you are relinquishing are present and that a sampler has signed all chains of custody.

11.1.3.18. Be sure to include sufficient ice to maintain a temperature of 4 °C until samples arrive at the laboratory. It is better to have too much ice than not enough.

11.1.3.19. Put the COCs in a large Ziploc bag and tape to the top of the ice chest.

11.1.3.20. Tape the ice chest shut and affix an EPA custody seal if this is deemed necessary because of the sensitivity of the project or if the security of the samples is questioned during transportation.

11.2. **Sample Preparation**

11.2.1. **Sample Processing**

11.2.1.1. Filtering DM samples using the vacuum pump and filter method

11.2.1.1.1. Pour water from the cubitainer or into a 150, 250, or 500 mL Nalgene 0.45 micron filter.

11.2.1.1.2. Secure vacuum pump and pressurize up to but not over 15 PSI.

11.2.1.1.3. Continue filtering until at least 125 mL are obtained and pour off filtered water into the 125 mL sample bottle until the filtered water reaches the neck of the bottle

11.2.1.1.4. In cases where water is excessively turbid and likely to clog the filter, a prefilter can be used to assist in the filtering process.

11.2.1.2. Filtering DM samples using a syringe and filter

11.2.1.2.1. Unpack syringe from wrapper. Triple rinse the clean syringe if it is not in a wrapper.

11.2.1.2.2. Screw on filter at the tip of the syringe or in some cases push on the filter to the tip of the syringe.

11.2.1.2.3. Remove the plunger and pour the sample water into the top of the syringe and replace the plunger.

11.2.1.2.4. Squeeze out filtered water directly into the DM bottle. At least two syringe volumes will be needed to fill the sample bottle; the same syringe should be used for both.

11.2.1.2.5. Fill the DM bottle to the neck.

11.2.2. **Sample Preservation**

11.2.2.1. Addition of preservative into metals samples can be accomplished in three ways:

11.2.2.1.1. Preservation by lab analysts after relinquishing to the laboratory (preferred),

11.2.2.1.2. Pre-preserve bottles used for sampling, and

11.2.2.1.3. Field preservation using acid ampules.

11.2.2.2. Preservation by lab analysts after the sampling event does not involve any extra work by field personnel other than ensuring the laboratory analysts are aware that preservation is needed. This should also be indicated on the COC.

11.2.2.3. Pre-preserved bottles do not require any extra work by the field personnel. However, field personnel need to be aware of the acid in the bottles to avoid acid burns and to also not overfill or spill acid out of the bottle which would cause improper sample preservation.

11.2.2.4. Field preservation of metals samples

11.2.2.4.1. Preserve each metals sample (total and dissolved) with a 0.5 mL ampule of nitric acid (HNO_3).

11.2.2.4.2. Turn away from other samplers.

11.2.2.4.3. Break off ampule cap.

11.2.2.4.4. Discard cap in $CaCO_3$/water mixture.

11.2.2.4.5. Hold open ampule over sample bottle (about 2" above water line).

11.2.2.4.6. Tap bottom of ampule to release the acid. Be sure not to touch the open ampule directly in the sample water..

11.2.2.4.7. Discard the ampule body in $CaCO_3$/water mixture.

11.2.2.4.8. If $CaCO_3$ is unavailable, baking soda will also work.

11.2.2.4.9. Disposable gloves and eye protection must be worn at all times during the preservation process.

11.2.2.5. Other samples that require acidification usually follow the same procedures, but with different types of acids. Check with the field lead or laboratory if

unclear.

11.2.2.6. Acid is not used to preserve the anions samples; they are iced to a temperature of < 4 °C.

11.2.2.6.1. Be sure to keep enough ice on-hand so temperature in the anions and nutrient samples does not exceed 4 °C.

11.2.2.6.2. Be sure ice is listed as a preservative on the bottle labels and COCs for these samples.

11.2.2.7. The table below lists the preservatives to be used for commonly collected samples:

Sample Type	Preservative
Total Recoverable Metals	HNO_3
Dissolved Metals	HNO_3
Alkalinity/Anions	Ice
Nutrients	H_2SO_4 and Ice
Total Nitrogen	HCl and Ice
Total Phosphorus	H_2SO_4 and Ice
Chlorophyll a (filtered)	Dry Ice
Chlorophyll a	Ice
Pesticides Primary Personal Care Products	Ice
Waste Indicators	Ice
Volatile Organic Compounds	Ice (no headspace)

11.2.3. Fill out sample tags and chains of custody as decribed. Attach tags to cubitainers and store samples in the appropriate coolers.

11.3. **Instrument or Method Calibration**

11.3.1. **Meter Chemistries:**

Meter chemistries are performed in situ. Samplers should always use meters that have been calibrated properly and should record all measurements in the field notebook.

11.3.2. **Multi-parameter Meters (Hydrolab):**

Refer to EPA Region 8 Laboratory SOP # EQOP-710 Calibration, Use, and Maintenance of the Hydrolab Multiprobe for detailed instructions.

11.3.3. **pH Meter:**

11.3.3.1. Calibrate the pH meter every morning prior to sample collection using buffers that bracket the expected sample range (buffers 4 and 7 in acidic conditions, buffers 7 and 10 in alkaline conditions). Values should be within ± 0.2 pH units of the expected value.

11.3.3.2. Be sure to record the following in the field notebook or the meter calibration log: date and time of meter calibration, meter number, and buffers used in calibration.

11.3.3.3. When using a refillable electrode, always check the level of filling solution and refill when necessary.

11.3.3.3.1. Make sure the rubber sleeve that covers the fill hole is down when taking pH measurements.

11.3.3.3.2. Always cover your electrode with the rubber cap and slide the

rubber sleeve over the fill hole when the electrode is not in use.

11.3.3.3.3. Always keep the electrode tip moist.

11.3.3.4. Rinse pH probes with DI water when transferring them from one solution to another.

11.3.3.5. Check expiration dates on buffer solutions regularly and replace when necessary.

11.3.3.6. Carry spare batteries.

11.3.3.7. When pH readings become erratic or appear abnormal, check the calibration of the pH probe by inserting it into buffer 7. The reading should be within ± 0.2 pH units of the expected value. If not, recalibrate.

11.3.3.7.1. Record the value in the field notebook and recalibrate the meter if necessary.

11.3.3.7.2. If problems continue, the electrode may need to be replaced.

11.3.3.7.3. Follow procedures described in the electrode instruction manual regarding probe setup and conditioning.

11.3.4. **LDO Meter:**

11.3.4.1. Always calibrate the LDO meter each morning before taking measurements. Instructions for calibration vary between make and model.

11.3.4.2. Record calibration procedures in the field notebook or meter calibration log.

11.3.4.3. Changes in elevation and barometric pressure can cause the LDO sensor to become inaccurate and recalibration should occur if significant changes in elevation or barometric pressure occur.

11.3.5. **Conductivity Meter:**

11.3.5.1. Calibrate the conductivity meter every morning prior to sampling.

11.3.5.2. A zero point calibration should be conducted with a dry conductivity sensor and another should be calibrated using a calibration solution higher than the highest expected conductivity reading during sampling.

11.3.5.3. Record calibration procedures in the field notebook.

11.3.5.4. Rinse the conductivity probe with DI water when moving from one solution or sample to another.

11.3.5.5. Always calibrate conductivity before pH.

11.3.5.6. Follow the manufacturer's instructions for storage of the conductivity probe.

11.4. Analysis

11.4.1. **Flow Measurements (General Information):**

11.4.1.1. Stream discharge is equal to the product of the mean current velocity and vertical cross sectional area of flowing water.

11.4.1.2. Discharge measurements are critical for assessing trends in stream water acidity and other characteristics that are very sensitive to stream flow differences.

11.4.1.3. Discharge should be measured at a suitable location within the sample reach that is as close as possible to the location where chemical samples are collected, so that these data correspond (EPA 2001).

11.4.1.4. Discharge readings are usually taken after collecting water chemistry samples to prevent disturbances in stream substrate from affecting chemical samples.

11.4.1.5. Discharge readings may be collected at the same time as water samples as long as they are taken downstream of the sample collection point.

11.4.1.6. Refer to EPA Region 8 Lab SOP # FLDM-721 Field Flow Measurements Procedure for a detailed description of field flow procedures.

11.4.2. **Velocity-Area Procedure (Flow Meter):**

11.4.2.1. Choose a good cross section:

11.4.2.1.1. Laminar flow - choose an area where flow is as "smooth" as possible.

11.4.2.1.2. Positive flow - make sure that there are no backwater areas where flow is likely to go upstream (negative), especially at the banks.

11.4.2.1.3. Avoid measuring at undercut banks and ice where water is likely to be flowing under the bank edge.

11.4.2.1.4. Avoid measuring immediately downstream of obstacles that are likely to disturb flow conditions (i.e. large rocks, tree limbs, islands, sand bars, etc.).

11.4.2.2. Make sure you are catching all the flow in your cross section. Be sure that any alterations you make (i.e. removing rocks or tree limbs) are done well before measurements are started.

11.4.2.3. Stretch a measuring tape from bank to bank across the stream and perpendicular to its flow.

11.4.2.3.1. Secure the ends of the measuring tape by tying the tape around a large rock or tree or by pounding a piece of rebar into the stream bank and putting the end of the tape over the rebar.

11.4.2.3.2. Be sure to keep the measuring tape taut to allow accurate cross section measurement and to prevent it from dipping into the stream.

11.4.2.3.3. Record the sampling station, facility/site description, sampling crew, date/time, stream width, meter type, and measurement units on the stream discharge form.

11.4.2.4. Choose an appropriate flow increment - the interval at which depth and velocity measurements are to be taken (i.e. 1 ft, 2 ft, etc.).

11.4.2.4.1. Choose a flow increment where you will get about 20 depth and velocity measurements across the stream.

11.4.2.4.2. The best way to measure twenty verticals is to divide the total width by 20 and round down to a convenient number.

11.4.2.4.3. The first vertical will be located at one stream bank and the last vertical will be located at the opposite bank.

11.4.2.5. Attach the velocity meter probe or Price AA or Pygmy to the calibrated wading rod.

11.4.2.6. At each flow vertical, stand downstream of the measuring tape, place the flow measuring rod in the water and measure the depth using the increments on the flow rod.

11.4.2.6.1. Each single mark represents 0.1 foot, each double mark represents 0.5 foot, and each triple mark represents 1 foot (see Figure 1).

11.4.2.6.2. In cases where the water depth is 2 feet or less, velocity will be measured at 0.6 depth.

11.4.2.6.3. To set the flow probe or propeller at 0.6 depth, line up the foot scale on the sliding rod with the tenth scale at the top of the depth gauge rod (see Figure 1).

11.4.2.6.4. If, for example, the total depth is 1.7 feet, then line up the 1 on the foot scale with the 7 on the tenth scale.

11.4.2.6.5. The sensor is now at 0.6 depth and velocity measurements can be taken.

11.4.2.6.6. In cases where water depth is greater than 2 feet, velocity will have

to be averaged from readings taken at 0.2 and 0.8 depth.

11.4.2.6.7. To set the sensor at 0.2 depth, multiply the total depth by two and repeat the above procedure.

11.4.2.6.8. To set the sensor at 0.8 depth, divide the total depth by two and repeat the above procedure.

11.4.2.7. Once the flow sensor has been placed at the proper depth, face it upstream directly into the stream flow.

11.4.2.7.1. Record the distance from the bank and the depth indicated on the wading rod on the flow data form.

11.4.2.7.2. Turn the meter on and allow it to equilibrate before recording velocity. Usually, one 40 second cycle is sufficient to obtain a stable velocity reading.

11.4.2.7.3. When using the Marsh McBirney flow meter where flow is not laminar and eddies cause the velocity reading to change erratically at the end of the first cycle, it will be necessary to run the meter for one or two more cycles before recording the velocity.

11.4.2.8. Move to the next flow vertical and repeat steps 4 and 5.

11.4.2.8.1. When using a Marsh-McBirney, be sure to reset the meter using the **ON** button at each new point and reposition the flow sensor at the proper depth.

11.4.2.8.2. Repeat this process until depth and velocity measurements are obtained for each flow interval. Figure 2 shows the layout of a stream cross section for flow measurements.

11.4.2.9. Tally the stream discharge at each flow interval by multiplying the interval width by the depth by the velocity.

11.4.2.9.1. Sum these interval discharges to obtain the entire stream flow.

11.4.2.9.2. If discharge at any one flow interval accounts for more than 10% of the total stream discharge, then additional verticals will have to be taken that bracket the verticals that violate discharge using a smaller increment.

11.4.2.9.3. In cases where flow is erratic (non-laminar), choose a smaller flow increment so this 10% rule is not violated.

11.4.2.9.4. A smaller flow increment will result in more flow measurements being taken across the stream.

11.4.2.9.5. It is important to note that flow increments do not have to remain constant.

- For example, with flow measurements at one foot increments and suddenly you encounter an area where water depth and velocity suddenly increase.
- In order to not violate the 10% rule in this one area, you may decide to decrease your flow increment to 0.5 feet.
- Because your flow increment is now half of what it used to be, the number of corresponding flow measurements will double in this area.

11.4.3. **Flow Measurements Using Flumes:**

11.4.3.1. Flows may be difficult to measure in smaller streams because they are too shallow to immerse the flow probe or propeller. In cases like these, it will be necessary to use a flume. The minimum depth a Marsh-McBirney can be used in is 0.2 feet and the minimum a Price Pygmy can be used in is 0.3 feet.

11.4.3.2. If the installation of a flume is not possible, but depths are too shallow for the

accurate use of a flow meter, the flow meter can still be used to take a measurement as long as the measurements are flagged as estimated.

11.4.3.3. Choose a good spot to place the flume. Look for an area where: water is flowing rapidly and is not pooled, substrate is available to dam up the flume, and the surface is level.

11.4.3.4. Place the flume in the flowing water and level it using a bubble leveler. Flumes are only accurate when they are level.

11.4.3.5. Assure that all water flows through the flume by damming up the sides with a shovel.

11.4.3.6. Make sure that the substrate used to dam the flume does not obstruct the flow of water or cause ripples to make depth readings inaccurate.

11.4.3.7. Record the inflow water depth (H_a) and the flume's throat size (i.e. 4 inches, 8 inches, etc.) on a flow data form or in the field notebook.

11.4.3.7.1. The downstream water depth divided by the upstream water depth must always be less than 0.5.

11.4.3.7.2. If not, it will be necessary to use a flume with a smaller throat size or place the flume in an area where water is flowing more rapidly.

11.4.3.8. Calculate the flow in CFS or GPM using the formulas shown in the table below.

Throat Width	Flow Rate	
	CFS	GPM
1 Inch	$0.50\ (H_a)^2$	$225\ (H_a)^2$
2 Inch	$1.02\ (H_a)^2$	$458\ (H_a)^2$
4 Inch	$2.08\ (H_a)^2$	$932\ (H_a)^2$
8 Inch	$4.22\ (H_a)^2$	$1900\ (H_a)^2$

11.4.4. **Flow Measurements Using The Timed Filling Procedure (Bucket and Stopwatch):**

11.4.4.1. In cases where flows have to be measured on a steep gradient or from culverts, the bucket and stopwatch method works best.

11.4.4.2. Capture all flow in the bucket and record the amount of volume and time in the field notebook or on a flow data sheet.

11.4.4.3. Do this at least three times and record the average flow in gallons per minute.

11.5. **Data Acquisition, Calculations, and Data Reduction**

11.5.1. A field notebook should be used to document everything that occurs during the sampling event. The following is a list of all things that should be placed in the field notebook:

11.5.1.1. Meter calibration procedures - buffers used for pH calibration, etc.

11.5.1.2. Weather.

11.5.1.3. Location sampled - include date, time and directions on how to get to the sampling site.

11.5.1.4. Field chemistries for the location sampled - pH, DO, conductivity, temperature.

11.5.1.5. Important contacts you make - include phone numbers and names of private property owners that you contact.

11.5.1.6. Changes made to sampling procedure and why.

11.5.1.7. Photos taken and a brief description - include photo number.

11.5.2. It's better to have too much information rather than not enough.

11.6. **Data Review and Acceptance Criteria**

11.6.1. Data packages submitted for peer review should consist of the following:

11.6.1.1. Peer Review form.

11.6.1.2. A Case narrative and draft Field Parameters report.

11.6.1.3. Copies of the relevant pages of the field notebook and instrument calibration logs.

12. Data and Records Management

12.1. All raw data should include the analysis date, analyst's name and/or initials, project name, control sample ID, and correct reporting units.

12.2. When a mistake is made on tags or COCs, cross out the error with a single line, initial it and write in the correction. The same procedure should also be followed when errors are made in the field notebook

13. Waste Management and Pollution Prevention

13.1. All waste must be placed in a properly labeled container, the name, amount and approximate concentration is recorded on the waste inventory sheet.

13.2. All waste materials must be packed out of the sampling location.

14. References

14.1. Rantz, S.E. 1982. *Measurement and Computation of Streamflow:* Volume 1 "Measurement of Stage and Discharge." U.S. Geological Survey.

14.2. U.S. Environmental Protection Agency. April 2003. *Surface Waters Western Pilot Study: Field Operations Manual for Wadeable Streams.* Environmental Monitoring and Assessment Program, Office of Research and Development. Washington, DC 20460.

14.3. U.S. Environmental Protection Agency. 2001. "EPA Region 8 Field Sampling Requirements." U.S. EPA Region 8. Denver, CO.

14.4. Chain of Custody form (GENLF-001)

14.5. Calibration, Use, and Maintenance of the Hydrolab Multiprobe (EQOP-710).

14.6. Field Flow Measurements Procedure (FLDM-721).

15. Attachments:

15.1. Figure 1 Top setting wading rod with a Marsh-McBirney sensor

15.2. Figure 2 Stream cross section showing measurement verticals and velocity measurement points

Figure 1: Top setting wading rod with a Marsh-McBirney sensor

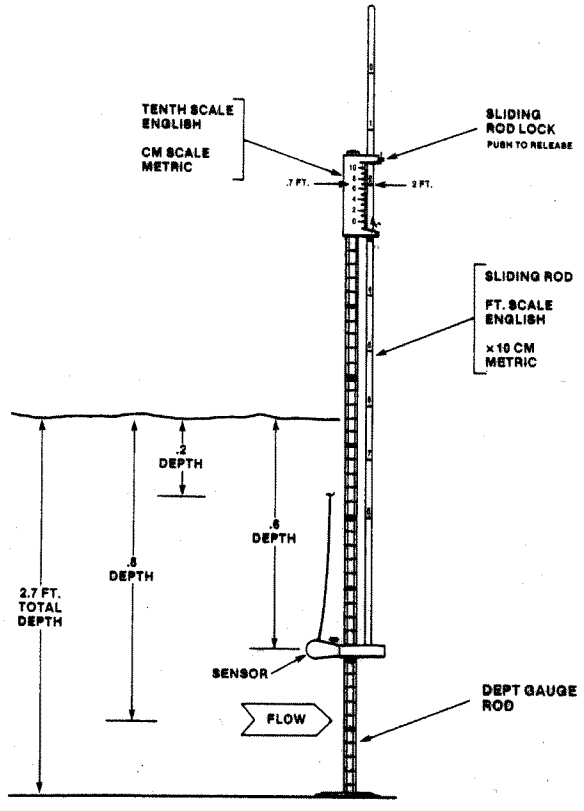

Figure 2: Stream cross section showing measurement verticals and velocity measurement points